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Beech Utilization Series No. 12

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Beech For Fuel And Charcoal

by

Laurance E. Webber

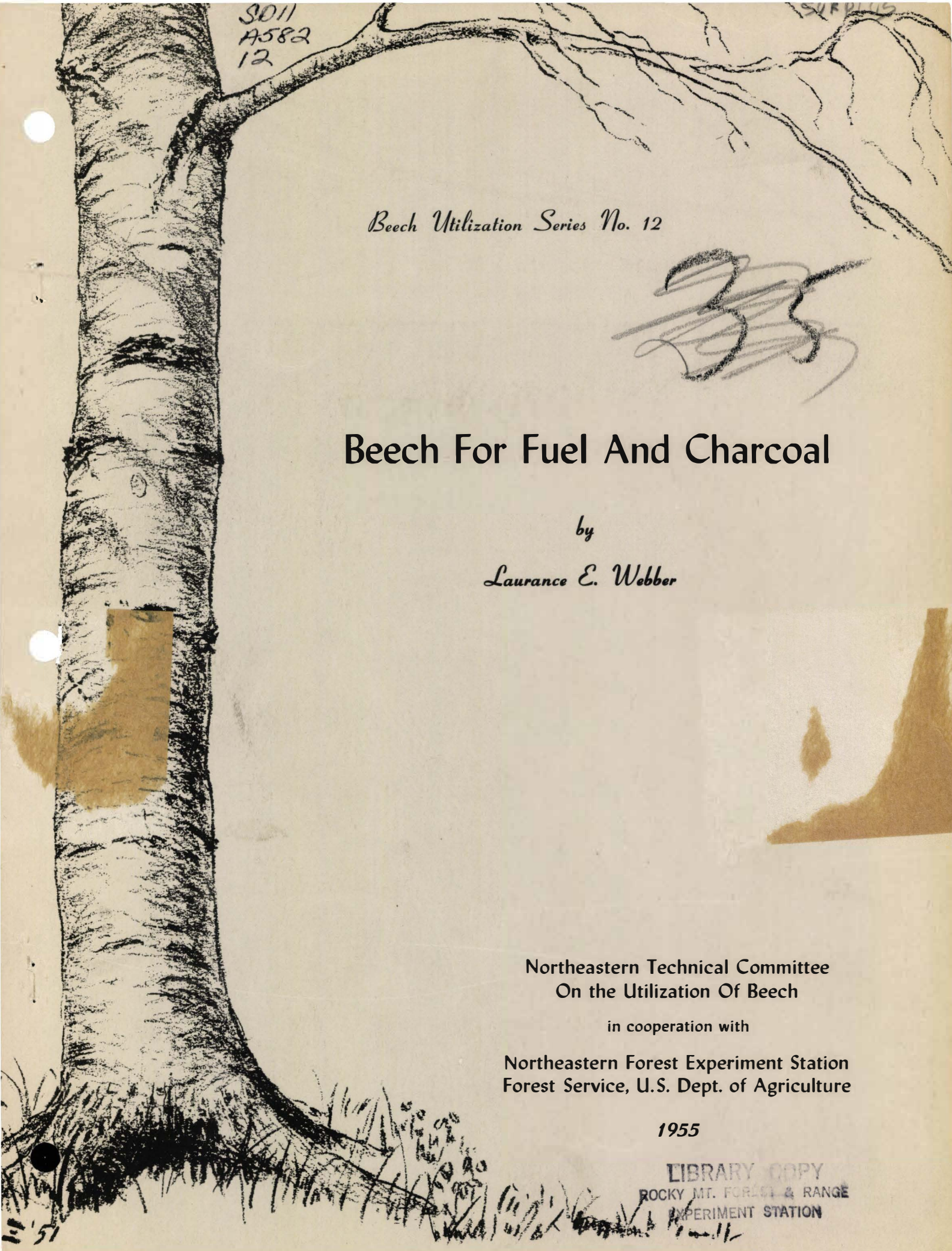
Northeastern Technical Committee
On the Utilization Of Beech

in cooperation with

Northeastern Forest Experiment Station
Forest Service, U.S. Dept. of Agriculture

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FOREWORD

The wood of the American beech tree (Fagus grandifolia Ehrh.) is well suited for a large number of uses, and it is rather widely used by manufacturers. Yet the amount used is not in proportion to the amount that grows in our northeastern forests. The utilization of beech--both in the woods and in the factory--has been recognized as a problem.

One reason for this is in the nature of the wood: it has a reputation for being difficult to season. Another is that many of the beech trees in our forests are of poor quality. And there are some plain prejudices against beech.

Research is finding ways to utilize beech as efficiently as any of the other comparable hardwoods can be handled. Considerable information about beech has been gathered. Yet most of this information is available only in fragmentary form in scattered technical reports. Some of it has never been published.

To study the problems of putting beech to the uses it deserves, and to promote the better management of the forests in which it grows, a Northeastern Technical Committee on the Utilization of Beech was organized in 1949. This committee, which includes representatives of Federal and State forestry agencies, universities, and state experiment stations, decided to assemble and publish the available information about the utilization of American beech.

As its part of this cooperative project, the Northeastern Forest Experiment Station has undertaken to edit, publish, and distribute the series of reports that will contain this information.

The subjects of these reports will be as follows:

- * Physical and mechanical properties of American beech.

(CONTINUED ON INSIDE OF BACK COVER)

BEECH FOR FUEL AND CHARCOAL

by

Laurance E. Webber

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USE FOR FUEL

BEECH IS ONE of our best firewoods. It burns steadily, gives off few sparks, and is much esteemed for fireplace use. It is probably no mere accident that the song tells of "The beechwood and the bellows," because beech has been a favorite wood for the hearth in northern Europe. Indeed, most Yule logs are pictured as beech.

Beech wood varies considerably in its ease of splitting, and branches tend to be very crooked. On the other hand, the wood seasons well and does not deteriorate seriously in storage when proper precautions are followed (2).¹

Beech is rarely used alone in cordwood, but is mixed with maple, birch, and other species. Firewood can be graded roughly as split wood, cleft wood, and round wood. Split wood usually has some round wood mixed with it. Cleft wood

¹ UNDERLINED NUMBERS IN PARENTHESES REFER TO LITERATURE CITED, PAGE 7.

is invariably cut 4 feet long and later is resawed or "fitted" for stove, furnace, or fireplace. Round wood is also cut "sled length," especially by farmers who cut it for their own use.

Various handbooks report that the heating value of beech wood ranges from 3,940 to 8,590 B.t.u.² per pound, depending on moisture content. In a series of tests, 44 samples (from 4 cords used to make charcoal) gave an average heating value of 8,272 B.t.u. per pound. This figure was computed on a dry basis; the samples averaged 4.4 percent moisture content by weight.

A cord of air-dry beech weighs approximately 2 tons and has a heating value of about 6,000 B.t.u. per pound. Thus a cord of air-dry beech is the heating equivalent of slightly less than 1 ton of coal, which has a heating value of about 13,000 B.t.u. per pound. A cord of beech wood is also equivalent to about 175 gallons of fuel oil, which has a heating value of about 140,000 B.t.u. per gallon.

A cord of beech wood can be expected to produce less than 100 pounds of ash, as compared with about 200 pounds of ash from a ton of anthracite.

It should be remembered that the greater the moisture content of the wood, the less its effective heating value. This is because the burning wood must provide the energy required to evaporate the moisture in the wood and bring this moisture to the temperature of the flue gases.

It is entirely feasible to use hogged wood in industrial installations. Tests reported by the University of New Hampshire (5) showed efficiencies up to 68 percent. If economical methods could be found to hog, transport, and store the material, the entire waste from a beech tree could be converted into industrial fuel.

USE FOR CHARCOAL

Commercial producers consider beech one of the best species for manufacture of dense charcoal. There are sev-

²THE B.T.U. (BRITISH THERMAL UNIT) IS ROUGHLY EQUIVALENT TO THE AMOUNT OF ENERGY REQUIRED TO HEAT 1 POUND OF WATER 1 DEGREE FAHRENHEIT.

eral methods of making charcoal. The general methods are: (a) in a pit or oven, and (b) in closed retorts. An inexpensive kiln of the oven type is described by Hicock and Olsen of the Connecticut Agricultural Experiment Station at New Haven (1).

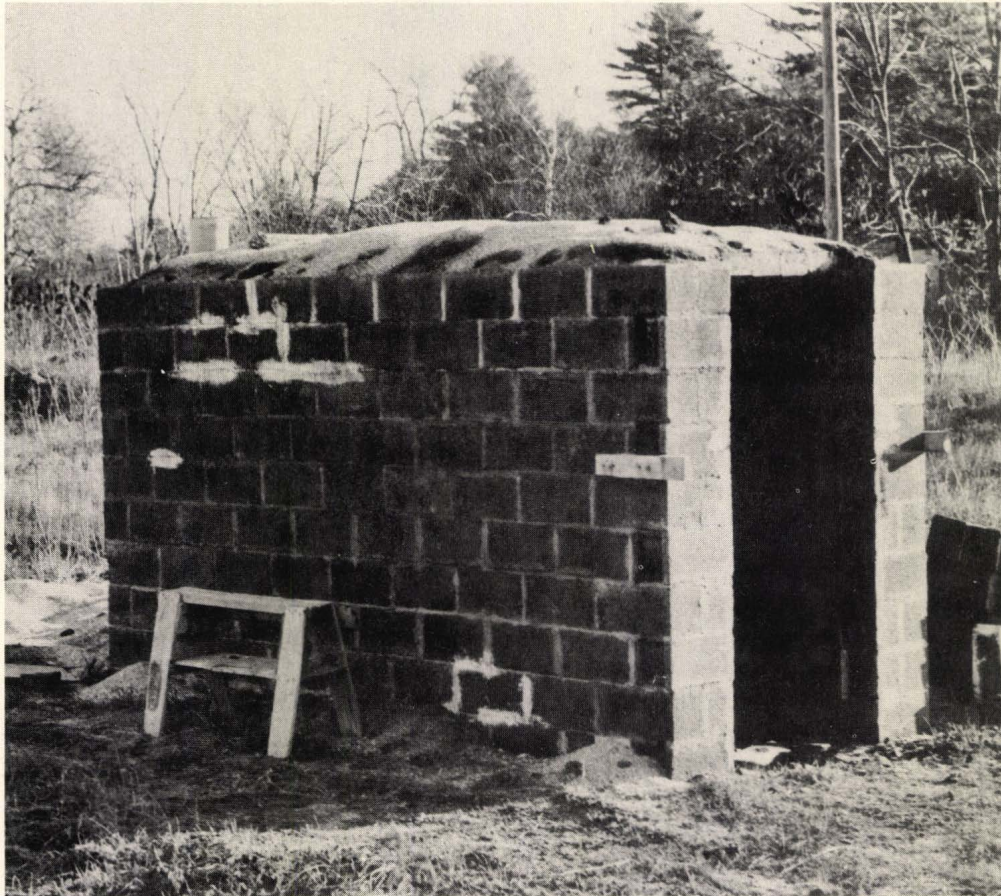


Figure 1.--The cinder-block charcoal kiln used in tests at the University of New Hampshire.

In a cinder-block kiln of this type (fig. 1) at the University of New Hampshire 6 cords of beech were used to make charcoal. Four cords were in 4-foot lengths while two cords were in chunks. These chunks--trimmings from veneer-log ends--were split into pieces not more than 6 inches in diameter (fig. 2). Figure 3 shows the kiln loaded with such beech chunks and ready to close.



Figure 2.--Beechwood chunks used in making charcoal.
The chunks came from trimmings off veneer logs.

The average heating value of 32 samples of the charcoal produced was 12,329 B.t.u. per pound, calculated on a dry basis. In as much as the heating value of pure carbon is reported to be 14,520 B.t.u. per pound, the indication is that the charcoal produced was of a fairly good grade. The heating value of charcoal is given as 11,000 to 14,000 B.t.u. per pound in Kent's Mechanical Engineer's Handbook (3).

About 25 kilns of this kind are being used in the Northeast to produce a good grade of charcoal from beech and

associated species. Yields of 800 to 900 pounds of charcoal per cord of wood are reported. The yields are generally somewhat less than the yield figures given in Marks' Mechanical Engineer's Handbook (4): 1 ton of charcoal from 2 cords of "hardwood." This is probably due to use of partially seasoned wood and losses from combustion in making the burn.

Most of the industrial charcoal--used in metallurgical and chemical processes--is produced in retorts. In re-



Figure 3.--The charcoal kiln loaded with beech chunks.

torts, of course, conditions can be controlled much more closely than they can in a kiln. The production of charcoal in retorts has declined in recent years, partly because the byproducts of such plants, methanol and acetic acid, cannot be marketed readily in competition with synthetically produced methanol and acetic acid.

MARKETING CHARCOAL AND FUELWOOD

Beech wood, in itself, is desirable both for fuel and for charcoal making. But profitable use of any material depends on the demand for it. Only careful analysis of markets can show whether it is profitable to manufacture charcoal or fuelwood from surplus beech wood.

In most localities in the Northeast there is a growing demand for charcoal, put up in small packages, for picnic and barbecue use. Most of the small kiln operators depend primarily on this market. The market is highly seasonal, but producers have been able to sell charcoal in small packages to local retailers such as gasoline stations, groceries, and hardware stores at twice the price per ton they could get from wholesale markets for charcoal in bulk.

It is recommended that anyone who contemplates getting into the charcoal production business investigate and cultivate this local market. Charcoal is bulky and somewhat difficult to handle. The local producer has a definite advantage over his competitors at more distant points.

Similarly there are many localities in the Northeast where there is a good demand for fireplace wood at profitable prices. This is particularly true around cities and in resort areas. Where these markets exist much low-grade beech can be converted into a high-grade fuelwood.

There is also a growing number of space heaters and furnaces designed specifically to burn wood efficiently. The farmer or the owner of a summer cottage might well be advised to investigate the advantages of such heaters, and to consider producing or buying low-grade hardwood to supply them. And he might bear in mind that beech is one of our best firewoods.

L I T E R A T U R E C I T E D

- (1) Hicock, Henry W., and Olson, A. Richard.
1948. THE CONNECTICUT CHARCOAL KILN. Conn. Agr.
Expt. Sta. Bul. 519. 41 pp., illus. New Haven.
 - (2) Scheffer, Theodore C., and Zabel, Robert A.
1951. STORAGE OF BEECH LOGS AND BOLTS IN THE NORTH-
EAST. Northeast. Tech. Com. Util. Beech and
Northeast. Forest Expt. Sta., Beech Util. Ser.
2. 13 pp., illus.
 - (3) Kent, R. T.
1936. MECHANICAL ENGINEER'S HANDBOOK. PART II (POW-
ER). 11th Ed. New York.
 - (4) Marks, L. S.
1941. MECHANICAL ENGINEER'S HANDBOOK. 4th Ed. 2274
pp., illus. New York.
 - (5) Seeley, L. E., and Webber, L. E.
1952. HOW EFFICIENT IS HOG-FUEL FIRING? Univ. N. H.
Engin. Pub. 13. 3 pp., illus.
-

- * Chemistry and chemical utilization of beech.
 - Management of beech.
 - Beech availability and supply.
 - Present markets and uses for beech.
- * Methods of logging beech.
- * Seasoning of beech.
- * Storage of beech logs and bolts.
- * Machining of beech.
 - Milling of beech.
- * Gluing techniques for beech.
- * Steam-bending of beech.
 - Preservative treatment of beech.
- * Beech for flooring.
 - Beech for furniture.
 - Beech for turned products and novelties.
- * Beech for veneer and plywood.
- * Beech for fuel and charcoal.
 - Beech for cross ties.
- * Beech for containers.
 - Pulping and defiberization of beech.
 - Rough construction on the farm with beech.

The Northeastern Station acknowledges gratefully the effort being devoted to these problems by the many agencies and individuals who are cooperating in this project. Among the leaders in it are David B. Cook, New York State Conservation Department; Claude Bell, U.S. Forest Products Laboratory; A. H. Bishop, State University of New York, College of Forestry; and Fred Wangaard, Yale University School of Forestry. These men, along with Fred C. Simmons and C. R. Lockard of the Northeastern Station, comprise the "working committee" that is directing and coordinating the project.

The information gathered in this widespread cooperative project should be of great use to the wood-using industries of the regions where the wood of American beech is available.

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